DEPARTMENT OF THE ARMY
FORT DETRICK
FREDERICK, MARYLAND 21701

SMUFD-TD 25 May 1967

May 25th Revision

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Dear [redacted]

Enclosed is the May 25th revision of the section on Biological Warfare which has been corrected in accordance with the views I received in our most recent meeting. If you have any further additions or corrections to suggest, I will be pleased to have them.

I am revising the section on Civil Defense and will send you a copy of it when it is completed - toward the end of next week.

Sincerely,

Riley

RILEY D. HOUSEWRIGHT
Technical Director

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For info -
+ Comments if you have any
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BIOLOGY AND NATIONAL DEFENSE

PANEL 23

Basically the national defense of any country is dependent upon the country's natural resources, its industrial potential, and the mental acuity, physical health and will of its people. The last quarter of a century in the United States has been marked by depletion and deterioration of its natural resources, by a rapid and large expansion of its industrial capacity, and by the improvement in the educational level and general health of its people. However, the steadily mounting toll of human life in highway accidents offers tragic evidence that improvements in the mental acuity and manual dexterity of its people have not kept pace with the improvements in the machines.

The rapid increase of knowledge in the physical sciences with the concurrent technological developments in communcations, transportation, and weaponry has claimed the lion's share of the attention of those responsible for National Defense for almost a quarter of a century. Tremendous improvements have been made in the machines and the weapons of warfare. Never before has the active fighting man been so well-equipped and so well-supplied. However, this heavy emphasis on the physical sciences and the technology growing ~~out~~ of our increased knowledge of chemistry and physics has not been matched ~~matched~~ by a corresponding development in ~~biology and~~ the technology growing out of biological knowledge. Truly effective national defense can only be achieved if the advances in the physical sciences are balanced by comparable advances in the biological sciences. Just as man has not yet achieved a satisfactory level of control of the speed and the power of the automobile on our highways, so has man not yet achieved a satisfactory level of control of the speed and power of the modern weapons of war.

Modern technology has brought profound changes, not alone to our individual lives but to our civilization and the institutions associated with it. Most of these changes have been accepted eagerly, but others cause much concern. Those causing concern arise either because no attempt has been made to adapt the design of the machine to fit the mental and physical capabilities of those people who are to use the machine or due to the failure of our society to devise and support research and educational programs which would enable our citizens to adapt better to the new machines and the changes which they bring to our lives. Man is an adaptable animal, but there is grave concern as to whether man can adapt rapidly enough to meet the many challenges presented by the new technology. Man' ingenuity in devising machines has outstripped his ingenuity in devising ways and means of developing in man the capabilities to master the machine and the environment which the machine creates. This is a matter of serious concern in our peacetime activities but may become the critical determinant in the success of our National Defense.

Our defense in the final analysis depends on our people. The machines will be no better than the people who make them and they will operate no more effectively than the people who operate them. The imbalance of the applications ~~advances~~ in the physical sciences versus those in the biological sciences are of concern in both the general peacetime welfare of our nation and in its national defense. Our report will concern itself only with those areas of special significance to national defense. These areas are:

I. The maintenance of the health of the military and civilian population.

II. Mental and physical defects and disease problems.

III. Biological warfare.

IV. Deterioration of materials of biological origin and deterioration of materials in general by organisms.

I. THE MAINTENANCE OF THE HEALTH OF THE MILITARY AND CIVILIAN POPULATION

a. Environmental health and sanitation

We pride ourselves as a nation on the improvements we have accomplished in our environment that affects our health and well being. By making our drinking water supply safe we have all but eliminated several of our bacterial diseases; by maintaining disease free dairy herds and by sanitary control of our milk supply and other dairy products we have practically eliminated Tuberculosis and other diseases spread by these food items. While all this is for the good, there are other subtle changes in our environment brought about by our increasing population, industrial activity, and our mode of transportation, that we cannot be proud of and may well have an adverse affect on our nations health. Although the increase in pollution of our water supply and of our air are not necessarily a matter that concerns national defense it does have an indirect bearing in that whatever affects our civilian well being does have an influence on our military posture.

In case of a national emergency due to military action there are some areas of our environment that can be of considerable importance to our national defense. Some of our large metropolitan areas are dependent on a single or very few pumping stations to supply the community with water. If some of these should be destroyed a safe water supply would certainly be jeopardized. In some communities we would be hard pressed to get sufficient water to keep the population alive. We can get along without food for awhile but not without water. Under such conditions the citizens would have to fend for themselves in obtaining water and then from any source available and sources may be highly polluted. While electricity is still available this could be rendered safe by boiling but if electric power is also out one may have to depend upon chemical sterilizing agents to render this water safe for drinking. Do we have supplies for this and does the average citizen know how to use these chemicals?

In case of a destruction of our water supply we would also be faced with serious problems in the disposal of our human waste. In our modern society we depend on water to carry these wastes to a suitable disposal area. With no running water we may have to resort to primitive means of disposal of these as well as the garbage. This will certainly have an effect on our environmental health. ~~Are we prepared to cope with this?~~

Through our improvement in food technology we have a safe supply of food and have reduced considerably the incidents of food poisoning. In case of a national emergency brought about by military action we may be deprived of much of our modern equipment that affects this problem and we may again be confronted with serious outbreaks of food poisoning and food borne Salmonella infections.

The control of food poisoning and food borne infections is still a grievous problem in our military establishments both at home and abroad. The feeding of large groups of people always increases the difficulty of avoiding food poisoning and our knowledge of the organisms involved is still too meager to allow adequate control. The recent work on the isolation and characterization of the staphloccoccus toxin is an important step in this direction but much remains to be done.

We are involved in world wide military ~~adventures~~ activities and this brings our troops into new types of environments that can affect their health and rewrite strengthen & assign to agency

well being. Their environmental health will therefore be an important problem for our military command and a knowledge of world wide environmental conditions is consequently more important now than ever before.

b. Nutrition

In a National emergency the shortage of food for the armed forces and the civilian population can become a reality even in our affluent society. In case of war on our own soil or an atomic attack, lack of food can become a serious problem. On the other hand if conflicts are confined to other lands, as has been the case in recent history, we should be able to cope with our food problems even though we may not have the large surpluses that has been our lot in the recent past. The problems we face in these two contigencies are so entirely different that it is best to deal with them separately.

Barring an atomic holocaust or armed invasion we are able to provide food for our armed forces and civilian population. This capability has improved considerable during the past several decades because of advances in agriculture and food technology. The latter is due in no small part to the research and development efforts of the federal government. Advances in food technology have been responsible for the development of many of our processed and convenience foods that have improved the diet of our armed forces and found wide acceptance by the civilian population. Research sponsored and supported by the Department of Defense and by civilian agencies with federal support has been responsible for many of the processed and convenience food items on the market today. These developments have undoubtedly improved greatly, the food supply of our armed forces. Further efforts in this connection can affect still further improvements.

Considerable effort has been exerted on the use of radiant energy for the sterilization of foods. This is a very laudable goal since it may make possible the preservation of many food items in a more wholesome and palatable condition for long term storage without refrigeration than has been possible in the past. One of the major problems here has been to overcome the deleterious effect radiation has on flavor and texture. Much progress has been made in overcoming ~~this difficulty thanks to the~~ research efforts of the ~~laboratories at Natick,~~ Massachusetts. Work ~~at this laboratory~~ has shown that food subjected to radiation at low temperature can be sterilized with minimal changes in flavor and texture but even these minimal changes must be overcome before a widely acceptable product is produced. It has not been possible however, to date, to destroy enzymes that are present even though the items can be sterilized. Consequently, if foods are to be preserved by irradiation for long periods of storage it is necessary currently to inactivate the enzymes by other means.

Before radiant energy sterilization can be approved for general use, an agreement must be reached regarding the level of initial contamination that needs to be overcome. When bacteria are killed by any physical process the viable population decreases according to a probability function, consequently the length of time required for any given treatment to affect sterility will depend upon the extent of initial contamination. An agreement on the extent of the initial contamination that must be overcome is therefore essential. ~~If~~ when a ~~reasonable~~ standard ~~can be~~ has been agreed upon, it ~~is~~ may be possible that radiant energy sterilization of foods can come into general use for our armed forces and civilian population. This development is particularly important for the sterilization of foods that are injured by temperatures required to destroy contaminating bacteria. A good example of this would be cured pork products such as ham and luncheon meat. An acceptable process of radiant energy sterilization would make possible long term stockpiling of such perishable foods.

In nature, many of our foods are preserved by dehydration. To this we owe the keeping quality of grain, nuts and cereals. Although our attempts to preserve other foods by dehydration have not been ~~laudable~~ very successful research has pointed the way to dehydrate successfully fruite juices, beverages, dairy products and some vegetable products.

Dehydration by lyophilization generally produces products that are satisfactory an easy to rehydrate when freshly produced but unfortunately they do not remain so on storage. Many such items including meats, undergo autooxidative changes in storage that render them unsatisfactory. In the past this has been believed to be due to the oxidation of lipids present but more recent work indicates that not only these but also proteins may undergo autooxidative changes. Much more basic research needs to be carried out before this difficulty can be overcome.

The great advantages of dehydrated foods is the saving of weight that is accomplished. This of course is important if foods have to be shipped over long distances. Foods that are to be dehydrated by lyophilization lose much of their weight but there is no corresponding reduction in volume. For long distance shipping reduction in volume may be as important as the reduction in weight. To accomplish this, compression is necessary but it remains to be seen whether foods that are dehydrated by lyophilization and compressed can be successfully rehydrated. If the above problems can be solved it would greatly facilitate shipping to and stockpiling of foods in remote areas of the world.

To sterilize food by radiation or heat or even to preserve foods through dehydration we must inactivate spore forming bacteria. We still do not understand the mechanism that confers resistance to these organisms to radiation, heat and dessication. Even though our knowledge of these organisms has expanded greatly due to federal supported research, continued support is needed if we are ever to learn how to inactivate these organisms without resorting to excessive radiation, temperatures or other environmental conditions which may injure the food itself.

In case of a nuclear attack or invasion of our shores we may be faced with some difficult problems in supplying food to our armed forces and civilian population. The very developments that have made possible the production of all of our processed and convenience foods, now a part of our civilian economy, compound our difficulties of supplying food to our population. The destruction of important food processing centers could seriously affect the quantity of these foods available on the market. The disruption of our transportation, through nuclear attack would make it very difficult to distribute these and other foods even though they could be manufactured. We might not then be able to supply the armed forces and the civilian population with the kinds of foods they are accustomed to. There would probably be a severe shortage of canned foods, if they are available at all, and destruction of our electric power supply would cut off much of our refrigeration. To compound these difficulties still further we are likely to be faced in the future with a situation where we no longer have large surpluses of food such as grain and dairy products thus making us dependent upon current production. Our current stockpiles of these foods have just about disappeared ~~due to our efforts to help feed the world.~~

For a number of years the Department of Agriculture has been ~~briefing their agents on emergency~~ studying problems that are likely to be created by an atomic attack or by invasion of our shores. By setting into operation plans which they have formulated they undoubtedly will be able to alleviate the situation somewhat. They will not however be able to prevent many serious difficulties that are bound to arise. Even though our agricultural capacities would not be seriously affected by direct atomic attack we would still be faced with some serious problems. Our farms are highly mechanized, depending upon machinery and fuel. The destruction of our manufacturing facilities that would result from an atomic attack and the distruption of our transportation would make it extremely difficult for our farmers to replace worn out machinery and to get sufficient fuel to operate the machinery they have on hand.

If we are to cope successfully with the problems that will be created following a nuclear attack we shall have to give much more serious thought to stockpiling of foods planned for emergency situations beyond those that are currently considered ~~by the Department of Agriculture.~~

Call Fitzgerald

The work done on nutrition in the past has concerned itself primarily with 1) the number of calories required to supply needed energy 2) the amount of proteins, carbohydrates and fats and minerals required to sustain growth and maintenance and 3) the amount of vitamins necessary for the proper functioning of enzymes. Even though these are the important facets of nutrition it is quite probable that there are other ways in which nutrition may affect a man' health and well being. Does nutrition influence a man's performance decision making alertness? If so we should know a great deal more about this facet of nutrition. Modern technology is providing man with many machines and weapons operated electronically requiring split second decisions on the part of the operator. ~~This puts a great demand upon a person's alertness.~~ Alertness ~~This~~ is clearly required ~~demonstrated in modern airplanes~~, where pilots are handling aircraft ~~equipment~~ traveling at several times the speed of sound. Alertness is also required for the average citizen who is handling our powerful modern automobiles. ~~If therefore nutrition does influence alertness it is important that this aspect of nutrition be thoroughly investigated.~~ The need for alertness + rapid performance decision making in modern warfare is so great that a strong research program in this field is justified, as an expenditure for national defense.

c. Man/machine interaction

History and statistics suggest that while deaths and disabilities from disease play a steadily descreasing role in military operations, the reverse tends to be true for non-battle injuries. Many of these arise from association with complex machines and vehicles and from exposure to certain types of environmental stress. Man is still in the process of learning to live with machines. Whether his rate of learning is keeping up with the rate at which machines are developed is perhaps questionable. Certainly any device ~~containing~~ delivering large concentrations of power ~~energy~~ is a ~~potential weapon and a~~ definite hazard. From the advent of the steam engine~~s~~, man's environment has included more and more complex machines. Society in general, as well as the Armed Forces, has had to deal with among other things, the internal combustion engine, the jet engine~~s~~, atomic devices, etc., and with vehicles incorporating them; for example, the railroad train, the automobile, the tank, the ship, the submarine and the spacecraft.

In addition to presenting hazards due to high energy concentrations, some of these devices have introduced man to marked, sometimes violent, changes in his immediate environment. He is exposed to exotic substances, to sharp changes in ambient pressure and to mechanical, electrical, radiant and other forms of energy whose use requires considerable care both in design and construction of the machines and vehicles which incorporate them and in their operation. While a study of the operation of machines belongs in part ~~more properly~~ to the area of behavioral and social sciences than to biology, design and construction involve very heavily what has often been referred to as the "man-machine inter~~face~~action". In problems of this kind one deals not only with psychological, sociological and economic factors, but also, and directly, with the knowledge and application of biological data. Examples of this include the preparation of life support systems for submarines, airplanes or spacecraft and for the protection of operators from their own machines, e.g. tanks.

Necessary biological information is obtained not only from the current state of knowledge, but also from special studies directed toward particular situations as they may develop. Of equal importance is the effective application of this knowledge to the design and construction of machines and vehicles. Progress in the accumulation of biological knowledge generally is continual and spurts of applied research are undertaken in response to immediate problems. Unfortunately, the time required to obtain information of direct relevance and to apply it is sometimes very long. The problem is an exceedingly complex one. The preparation of vehicles, weapons systems and procedures involving their use often involves elaborate considerations of the cost and time required on the one hand and the relative effectiveness and risks on the other. This type of analysis is particularly difficult to apply where significant research is involved. Problems especially in biology, are not necessarily solved on schedule and important unpredicted results are sometimes obtained. Also, while fruitful applications of basic research may take years to develop in the physical sciences, they may take a great deal longer in the biomedical areas if only because the problems are much more complex. As a rule basic research results are not in directly useful form and much of the applied research is intended to provide relevant numerical information for specific situations. Thus, a good deal of the resulting data has a limited usefulness beyond its immediate sphere of application.

Data from applied research are what is needed for design and construction. However, the preparation of specifications is often complex and time consuming in relation to modern machine devices. The inclusion of human beings and their characteristics into systems design complicates the problems greatly. Not only is there a need for free communication between biologists and engineers, but there should also be people available with sufficient familiarity with both aspects to act as interpreters.

It is clear that broadly based research in the biomedical field not only contributes to the advancement of biology, but also provides an essential pool of knowledge from which material can be extracted as the need arises. In addition to this, there must be a sufficient number of people available who are not only familiar with the scientific background but who have an understanding of the circumstances under which the knowledge mustbe applied in engineering and in operational situations.

The above comments should not be taken to imply that present activities are completely inadequate. There is strong support throughout the country for basic research in biomedical areas and there are a number of government laboratories whose work has been essential both in obtaining and applying it. However, there are many areas in which environmental stresses have been nowhere near as carefully studied as they should be and the efforts needed for effective communication among biologists, engineers and decision makers are still unnecessarily great. In the study of injury related to machinery and unusual environmental stresses much has been done in the past and will continue to be done. However, further increase in the rate of technological development may strain our resources for meeting emergencies. The host of biomedical problems which have arisen out of the discovery of nuclear fission and its technolpgical applications are still far from being solved after over 20 years.

Recommendation — Underline

The design and development of medern military weapons systems has given inadequate consideration to man's ability to control them. A greater and sustained effort must be undertaken to study the interaction between these systems and the men who are to operate them. Particular emphasis should be given to the biological hazards which could result from radiant and other forms of energy produced by these systems and from the many stresses acting individually and in combination ~~and~~ in our operation environment.

d. Effect of High Energy Radiation and the Environmental Hazards

Durin the past decade there has been a considerable effort made to better understand man's ability to adapt to the space environment largely through the impetus of the manned space program. More recently programs to understand man's adaptation to underwater environment through the Sea Lab experiments and the like have been initiated. The armed forces encounter many unusual environments without the benefit of previous studies on how man can adjust to them. With the advent of limited wars often in remote areas, we have to come to grips with the effects of heat, moisture, humidity, altitude, and other environmental factors which affect the performance of the military man as distinct from the health implications which are discussed in another section of this report. Advance knowledge on the effect of these climatic conditions on man would be very helpful in the military situations. The lessons that we have learned and are learning in VietNam suggest that our efforts have not been adequate in the past to provide sustained information for military use.

In addition to climatic environmental factors there are a host of new conditions which are superimposed on the military man as a result of new technology, new weapons, new tactics and the like. The possibility of more prolonged exposure to natural radiation as a result of high altitude aircraft is an example. Others might include the potential hazards of RF energy from radar and other devices which produce non-ionizing radiation; increased noise from jet engines. In addition, military units are often placed in somewhat isolated situations and are also transported rapidly, which has a tendency to disturb their normal adaptive mechanisms. Although some efforts have been made to study the effects of these environmental hazards on man, they have tended to be underfunded, short range, and frequently do not take into account the multiple effects of two, three, or many hazards in combination.

Increasingly complex machines which require rapid decision making have also contributed problems of adaptation. There would therefore be merit in writing into the specifications for a large scale weapons system, a comprehensive analysis of the various factors which may degrade the performance of the human operator. Problems specifically include vibration and noise in tanks and decision making in low-flying, high-speed aircraft. In this regard emphasis on practical bioengineering is required.

Considerable effort has been spent and progress made in extending the "motor function" of the military unit. To lesser extent, there has been an effort to increase man's sensory input through advanced engineering models which permit him to see and hear remotely. There is some reason to believe that a more careful anatomical-biophysical representation of the actual sensory systems which occur in nature might provide the blue-print for more advanced weapons systems of the future. One can hardly underestimate the importance of developments in this area when one considers the decision making which is required in the defense posture of modern military forces. Important as decision making may be in determining strategic or tactical operations, the sucess or failure will depend to a considerable extent on the validity and timeliness of the information presented to the decision maker. Biology should be vitally concerned with this process as well as other disciplines related to the Life Sciences.

Man is still in the process of learning to live with machines. Whether his rate of learning is keeping up with the rate at which machines develop is perhaps questionable. In any case, he must try his best lest the machines overwhelm him. Furthermore, modern transportation exposes people not only to close contact with machines, but subjects them to an ever increasing variety of environmental conditions at a more rapid pace than ever before. One day a man may be in a temperate climate living a routine life and the next he may be in a hot, humid climate working, say, with jet aircraft or he may find himself in the artificial and perilous position of a crew member of a deep submergence vehicle in the ocean.

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e. Non-specific Factors Involving Resistence and Infection

The efficacy of immunization procedures for the prevention of a considerable number of infectious diseases is well known. The principle on which these procedures are based is the production of antibodies in the host (active immunication) by inoculation of the infecting agent or an extract or a product of that agent. Notable examples are the successes in prevening diphtheria by administration of diphtheria toxoid or of piliomyelitis by the administration of killed or living attenuated viruses. In most instances the immunity thus produced is a durable one, lasting for months or even years. In contrast, the protection produced by the administration of antibodies formed in another host, whether it be another man or an animal, is transient, usually lasting for not more than 4-6 weeks, and thus has very little usefulness.

In contrast to the notable successes, however, there are many diseases which cannot be prevented by active immunization. In some instances the infective agent cannot be detoxified or inactivated to a point where it is safe to employ; in others the disease itself does not confer immunity when it occurs naturally and resistance to infections does not follow artificial immunization with the infective agent. In still others the sheer number of antigenically different infectious agents is too large to make practical any immunization procedure. An example of this last category is found in the rhinoviruses which are common causes of milk upper respiratory tract infection and now appear to number more than one hundred antigenically and immunologically different types of viruses which show no cross immunity one-to-another. Moreover, the efficacy of some of our oldest vaccines is still not adequately established. An example is cholera vaccine which was the first bacterial vaccine to be used; another is typhoid vaccine. It is obvious that approaches other than active immunization are needed.

An approach which has been highly successful for certain diseases has been the use of a variety of chemicals and drugs for both the treatment and the prevention of infectious diseases. Sulfonamide drugs and penicillin are two examples of such drugs. They have been highly effective both therapeutically and prophylactically against certain bacterial and rickettsial agents and a few fungal and protozoal agents, but even here difficulties are being encountered. The capacity to mutate of the microbial agents, which in general have a generation time of minutes or hours, has led to the appearance or selection of resistant strains of organisms. Three examples may be given: the chloraquine-resistant strains of falciparum malaria, the penicillin-resistant strains of staphylococci and the sulfonamide-resistant strains of meningococci. This phenomenon of resistance means not only that new drugs should be sought, but that old ones should be re-tested. In general, chemotherapy have not been effective against virus diseases. Recently, however, some success has been reported in the use of deoxyuridine compounds in herpes infections, thiosemicarbazone compounds in the suppression of smallpox after exposure and before the development of clinical symptoms, and the limited experience with adamantine in the prevention of the Asian type of influenza. At the present time these successes can be considered as no more than modest and work along these lines should be encouraged.

There is a third and much more difficult approach that has been discussed and investigated to a limited degree over the years, but now should be urgently pursued: Nonspecific factors involved in resistance to infection. It has long been known that certain animal species are resistant to infections to which other animals are susceptible. The nature of this "natural immunity" in unknown. It is also known that in man and other animal species there are a number of nonspecific reactions to infections that seem to be defense mechanisms of the host. One of these is the inflammatory reaction that ordinarily occurs at the portal of entry of the infectious agent and is usually characterized by increased capillary permeability, lowering of the pH, infiltration of leukocytes with resultant phagocytosis, and the accumulation of circulating substances such as complement and properdin. Other nonspecific defense reactions such as fever and granuloma formation may also be cited as examples.

At the present time considerable attention is being given to a substance called "interferon". This substance is apparently a protein which is produced nonspecifically when cells are exposed to a variety of substances such as certain viruses, polysaccharides (Statalon), phytohemagglutinin, some mycoplasma organisms, extracts of some fungi, and certain synthetic anionic polymers. The action of the interferons so produced is species-specific in that it will prevent infection only in cells of the same species in which the int[illegible] Interferon once produced is not specific for the inducing virus or substance, but will act on other indiscriminantly. Interferon is nontoxic, nonantigenic, and readily excreted in theurine, but also to some extent persists in the body for weeks or perhaps months. It is being tried prophylactically and therapeutically both by local applications and systemic injections. Under certain circumstances interferon seems to inhibit the clinical manifestations of infection but does not prevent subclinical infection and subsequent immunity. One of the major problems in evaluating interferon has been the difficulty of producing it in quantity from a human exogenous source so that adequate amounts can be administered either prophylactically or therapeutically in controlled trials. A more hopeful approach seems to be to stimulate the endogenous production of interferon and interferon-like substances by the administration of nontoxic and non-antigenic inducers of interferon synthesis in the host. For example, in anticipation of an epidemic of a virus disease of known or unknown etiology for which no effective prophylactic or therapeutic measures were available, such as occurred in the 1957 pandemic of Asian influenza, susceptible populations could be treated with drugs which stimulate nonspecific hosts mechanisms, such as interferon, against the infecting agent.

The importance of these nonspecific factors is great and they may well provide the solution to otherwise insurmountable problems. Investigative work in this field should be stimulated by special funding, encouraged and supported.

II. MENTAL AND PHYSICAL DEFECTS AND DISEASE PROBLEMS

a. Manpower availability through the Selective Service

There is ~~a massive~~ an enormous pool of ~~facts and figures~~ data available on rejection rates for selective service. Much of this data cannot be directly compared, for example, between World War I, World War II, the Korean conflict, and the current conflict in Viet Nam. The reasons are basically because the standards for acceptance vary depending upon the complexity of the machinery of war and a~~lso~~ because the total manpower requirements vary. ~~tremendously.~~ ~~Obviously the~~ Standards become less stringent when large numbers of soldiers are required as was the case in 1942 to 1944 in World War II. Nevertheless, there are some rather interesting trends which have been ~~noticed and~~ reported. *This has been summarized ~~very~~ well by Bernard ~~D.~~ Karpinos with the Medical Statistics Agency, Office of the Surgeon General, Department of the Army.

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Mr. Karpinos points out that during the period 1964 - 1965, approximately two million draftees were forwarded to the armed forces examining and induction stations for pre-induction examination. Somewhat less than half a million of these examinees were disqualified for medical reasons, and almost the same number failed to pass the mental test. Some 40,000 of these draftees were approximately twenty years of age. This in itself is a rather frightening statistic. On a percentage basis, 23.4% of the total number failed to meet the current mental requirements; 21.4% failed the mental tests only; and 2% failed the mental test and were also disqualified for medical reasons. Of the non-Negro draftees, 15% failed the mental test on a nationwide basis. Of the Negro draftees in 1964 - 1965, 63.3% were disqualified on the basis of mental examination. Thus, the disqualification rate for the Negro draftees was approximately four times as high as for the white draftees. By comparison it should be noted that the overwhelming cause for rejection during World Wars I and II was for physical defects alone.

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* may wish to leave out.

~~There are also geographic differences which range from a rejection rate of 14.4% in the north central region of the country to 36.5 in the south (mental test rejections). Even greater differences were found in particular states. For example, the rejection rate in Iowa on the basis of the mental test was 6.4% whereas the rejection rate in Mississippi was 59.7%. Rather complete tables are available in this article. The point is that there are obviously differences in rejection rate on both a geographic and ethnic basis.~~

Studies have been undertaken to determine the reasons for this high rejection rate. It should be pointed out that the mental test used in the selective service system the AFQT, is primarily designed to measure the examinee's general mental ability to absorb military training within a reasonable length of time and to provide some uniform measure of the examinee's potential general usefulness in the service. It is specifically intended to predict potential success in general military training and performance and was validated for that purpose. The AFQT differs somewhat from previous mental tests used by the services. A number of correlations were made to attempt to relate the AFQT scores with educational attainment. If one compares the median scores on an ethnic basis alone, there seems to be no very significant difference with respect to education attainment. However, if one considers the data on the basis of geographic and ethnically differentiated groups, there is a very marked difference. In summary, it appears as though the determining factors on mental rejection are not only related to the level of formal education and its quality but to interrelated socio-economic factors outside the school.

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Some interesting data is presented in Medical Statistics Bulletin No. 1 which might be useful in comparing the situation in 1941 with the current rejection problem. During the period of 1940 to 1941 (May 31) approximately two million draftees were examined by local boards. Of this two million, approximately one million were rejected for general duty; however, an additional

500,000 were acceptable to the armed forces on a limited basis. Hence, an overall rejection rate of approximately 25%. Of the one million rejected for general military service, 900,000 (90%) were rejected due to physical and mental disease. Only 100,000 (10%) were rejected because of the lack of educational or mental qualifications. A sample of the two million draftees, the sample size being about 20,000, shows an interesting breakdown of the reasons for disqualification. The major cause for rejection was defects of the teeth accounting for 20.9%; defects of the eyes accounted for 13.7%; cardiovascular system defects, 10.6%. Mental and nervous diseases ranked sixth on the list of causes for rejection with a percentage of 6.3.

Some additiona information in Medical Statistics Bulletin No. 2, August 1, 1943, provides data from the period November 1940 to September 1941 at which time three million registrants had been examined by local boards and eventually at inducation stations. By this time the overall rejection rate was about 52.8%, not unlike the current rejection rate. At this point, however, it is well to point out that the draftees ranged up to 35 years of age and were to some extent a pre-selected sample since presumably some of the healthier specimen were not brought into the service through the selective service system but volunteered for duty. Using this somewhat larger group, 16.5% of the rejections were now caused by dental defects; mental and nervous defects accounted for approximately 10.5% and now moved into third place as a cause for rejection. The most interesting statistic in this report from the panel's point of view is that the Negro rejection rate based on these three million registrants showed a rejection rate of 51.9 which is in marked contrast to the current situation. A separate comparison of the causes of rejection showed that among the white population, the major causes were teeth, eye, cardiovascular and then musculo-skeletal. Among the Negroes the major causes were syphillis, educational deficiencies, cardiovascular, and musculo-skeletal.

The next comparable period of study was reported in Medical Statistics Bulletin No. 3 from April 1942 to December 1943. This data is based upon a 20% sample of approximately nine million men examined. The rejection rate varied month by month from a low of 31.4% in January 1943 to 46.9% for December 1943. White rates were consistently lower than Negro rates throughout the entire period. The lowest Negro monthly rejection rate was 51.2% while the highest for whites was 42.9%. These differences held for each age group. Rejections increased in direct relation to age from the middle thirties on, reaching over 50% of all registrants examined. The principal cuases for rejection for white registrants were in order of magnitude mental disease, musculo-skeletal defects, cardiovascular defects, educational and mental deficiencies. For the Negroes the major causes of rejection were educational and mental deficiencies, syphillis, mental disease, cardiovascular defects. Higher rejection rates were found in the south while the lowest rates were found in the states in the northwest. During this period, mental disease was the major cause of rejection ranging from 12.5% to 17.9%. Mental deficiency was second in importance ranging from 10.7% to 14.2%. Rejection on the basis of mental deficiency was considerably higher among the Negroes than rejection for mental disease, whereas the reverse was the case among the whites during this period.

Medical Statistics Bulletin No. 4 covers theperiod January 1944 to August 1945. During this time, approximately 5,700,000 registrants had been examined of which about 44% were rejected for general military service. Many of these examined were under the age of 26 and were deferred because of being in essential occupations, although some were being re-examined who had previously been rejected. Again the leading causes of all rejections were mental disease, 26.8%; failure to meet the mental standards, 12.8% musculo-skeletal defects; and cardiovascular defects.

For comparative purposes, [illegible] study was made of the qualifications of Americans used for military service from the period of July 1950 through June 1960. This was broken into three periods; the so-called Korean War period July 1950 through July 1953; a second period of August 1953 to July 1958; and the third period from August 1958 to June1960. Although the overall disqualification rate goes from 34% in the first period to 40.4% in the second period and 51.2% in the third period, a comparison shows that only 16.2% of the draftees were rejected for mental reasons during the third period. It is interesting to note that although some 5.5% of individuals examined for military service during the entire World War II were disqualified because of psychiatric conditions, the disqualification rate for psychiatric reasons during this later period is around 2% due to a modification of standards. However, the rejection rate for failure to meet the mental test continues to rise. This is in part due to more stringent mental requirements added to the military testing program in 1958. Within the category of physical disqualification, the major causes in descending order are defects of bones and organs of movement, psychiatric disorders, circulatory system diseases, eye diseases and defects. This is from August 1953 to July 1958.

If one compares the period of 1962 to 1965 with the period July 1950 to December 1961, one finds that the overall disqualification rate has gone up a few percentage points. The general causes for rejection seem to be about equally divided between medical causes and failure to meet the mental requirements.

It is clear that the overall rejection rate depends to a large extent on the manpower demands; hence, 75% of all draftees in World War II were available for some form of duty whereas from theperiod following World War II to the present, the overall rejection rate tends to remain fairly constant at bout the 50% level. Both mental and physical standards have been raised and lowered according to manpower requirement. The proportion of rejectees for mental disease as distinct from education and mental level has decreased due to a change in the standards since World War II. Perhaps the most salient statistics are these: Since 1960 and through June 1966, about 35% of white examinees were disqualified whereas 64% of the Negroes examined were disqualified. Therefore, the disqualification rate for Negro examinees is 80% higher than for white examinees. The primary difference in these disqualification rates by race are due to mental test failures. As a matter of fact, disqualification for medical reasons alone shows a lower rate among the Negroes than among white examinees. The disqualification rate for mental test failures among Negro examinees was four times as high as among white examinees. While one out of seven white draftees failed the mental test, about three out of five Negro draftees failed, quite a disturbing cultural and socio-economic phenomenon.

Rewrite & condense

The analysis of the causes for purely medical reasons for disqualification shows that there is really very little that can be recommended. The causes for rejection reflect generally the major health problems extant in the general population. Disqualification for physical reasons will no doubt decrease as we improve our knowledge about the causes of disease. However, there is an alarming rate of rejection on the basis of mental tests. This is surely not a matter for national defense alone but in one sense is a measure of the overwhelming need for improved education, particularly in the socio-economically depressed areas. If the statistical data since World War II has any value at all, it suggests that the relative rate of rejection for failure to meet the mental standards will continue to increase, probably in direct relation to the complexity of modern warfare. This situation will not cure itself. Nationally there are already a number of programs designed to increase educational opportunities for our youth. It is doubtful whether our panel can do any more than simply endorse this effort and to point out the importance which it also has with respect to national defense.

b. Morbidity and Mortality Data from the Various Wars

WE HAVE NO INFORMATION ON THIS

c. Information of respiratory diseases among the recruits

WE HAVE NO INFORMATION ON THIS

d. Diseases of Military Importance

Relatively few infectious diseases whether spread directly or by insect lectors are important health hazards in the United States at the present time. Due to a number of factors such as effective Public Health programs, improved sanitation, improved vacccines, early diagnosis and isolation, etc. Some of the infectious diseases common in past years are becoming so rare thatour medical students do not have the opportunity to serve actual cases. Our relative security from such diseases in this country make us more or less insensitive to the situation that exists in other lands.

A few years ago we thought the malaria problem had been vertually solved and we could look forward to the day when this disease would be a thing of the past. The conflict in VietNam has shattered this view. The new strains of/the malaria parasite encountered there make us aware that malaria is still a very serious problem for the populations in many countries and for our troops that are stationed there.

Malaria is only one example of the neglected disease that our troops encountered in foreign countries. Many, if not most, of these diseases have either been overlooked or neglected by our medical research scientists either because they were not aware of the existence of some of these diseases or because funds were not available for their study. Following are a few examples of infections that afflict our troops; infections we should know much more about before we commit troops to serve in areas where these infectious diseases are prevalent. Some of these diseases are not necessarily only in other lands but are also prevalent in the United States but because of effective control measures they may not be very prevalent and therefore further studies of them have more or less been neglected.

Veneral diseases are a serious problem in many of the Asiatic countries where prostitution is very prevalent and not being controlled by the local government. Problems of resistant gonococcal infections appear now to be certainly associated with common Staphlcoccos infections in which the commonly used antibiotics are no longer effective. Scrub Typhus is not uncommonly found among the troops in Viet Name and Taiwan. Better and less dangerous drugs are neededand we have yet to find a vaccine.

Bacterial and amoebic dysentery are two important diarrhial diseases that crop up quite often among the military even with the precautions for boiling water, peeling fresh fruit and not eating fresh meats and vegetables. The vegetables are often grown on land fertilized with night soil even though synthetic fertilizers are becoming more widely employed. Meats brought to the local market are not generally refrigerated or if they are, they are put on ice which is [redacted] made from polluted water.

Haemorrhagic-dengue apparently is serious in Viet Nam although the haemorrhagic manifestations may not be as apparent as seen in native populations who are repeatedly exposured to the disease. A reliable vaccine is needed to control this disease.

Japanese encephalitis is apparently an importan disease among the troops in Viet Nam and Thailand. A vaccine is being tried that is derived from a formalin killed mouse brain antigen. Efficacy of this vaccine has not been fully documented.

Schistosomiasis is an important disease in the swampy areas of Niet Nam. Other diseases preveland in Viet Nam are Leptospirosis and cholera.

Several Army and Naval medical research units are making very important contributions in their studies of several of the diseases that are being encountered by our troops in the Asiatic areas. Many of these units are working under severe handicaps however,due to a large turnover in personnel every two or three years. Also, they do not have enough funds to carry their programs at a high and effective level. Furthermore, as soon as our commitments in these areas are completed,support for these researches will undoubtedly be cut.

While the examples given above are mainly for diseases that have been encountered by our troops in the Asiatic area there are diseases in other parts of the world which we might become involved in the future and if and when we do we will probably run into the same problems there that we have been in the Asiatic area by having to set up emergency units to study new diseases with which we are unfamiliar and for which we have no prevention or cure.

While many of the diseases which are of military importance are not necessarily tropical diseases we have in the past used the term "Tropical Diseases" to designate most of the diseases that are found in other countries; not particularly common in our own country. For this reason it is appropriate at this point to call attention to a study entitled Topical Health - A Report on a Study of Needs and Resources which was published in 1962 by the National Academy of Sciences, National Research Council (NAS-NRC). In relation to our needs and resources at that time we were believed to be suffering from a deficiency of personnel and would continue to do so. The U. S. medical schools in 1959 had only 293 teachers of tropical medicine and parasitology and the total number of personnel engaged in research in this area in the government, private research institutions, medical schools and universities and drug companies was 507. It was noted that opportunities for securing advanced training in the USA were small. The advisory committee responsible for this report offered a series of resolutions, the most important of which was the establishment of an advisory organization within the NAS-NRC for a National Program for Research in Tropical Health. This organization was not established. In the Annual Report 1962-63 of the Division of Medical Sciences, NAS-NCR, in relation to the recommendations of the Tropical Health Report it was stated that "Unfortunately no progress has been made toward the goal of a nationally conceived program of research in tropical health that was called for by the Committee. It is evident that the missions of the several operating government agencies involved are so individually oriented that it will be no easy task to achieve scientific and administrative coherence in prgramming. Nor is the time propitious. The critical attitude of Congress toward foreign aid is compounded by the deep concern of the administration with the imbalance in the golf flow." On all fronts the situation today, insofar as information is available, is unchanged.

What has happened to tropical medicine in the "laisse faire" atmosphere of the intervening period? The Tropical Health Report used the membership of the American Society of Tropical Medicine and Hygiene as an index of interest in the field. In 1945 there were 1309 members, and in 1952 and 1965, respectively, 1074 and 1291 members. The department of Defense has closed the Tropical Disease Laboratory in Puerto Rico. The Laboratory of Parasitic Diseases at the National Institute of Health, one of the great laboratories for tropical medicine research, is contracting sharply, and so are the International Centers for Medical Research and Training, some of which have been closed down. Recent interest in malaria due to the occurrence of resistant strains in Viet Nam has resulted not in a marked expansion of tropical medicine as a whole, but in some contraction of programs on other tropical diseases.

In order to remedy the situation, some sort of coordinating agency is necessary to provide more and better teachers in the medical schools. The provision of direct experience in the tropics for carefully screened students with a true interest in the field is necessary. More postgraduate training opportunities should be available, and, finally, the ability to utilize the interest engendered and the training gained in the previous program for the development of careers in tropical medicine is absolutely essential. In relation to research in tropical diseases it should be pointed out that the developing countries are not putting the provision of health services at the top of their budgetary priorities, and within the health area, research cannot even be considered by a majority of these countries. The responsibility for research in tropical medicine thus devolves upon the developed countries. In summary, therefore, it is necessary to establish coordinated programs for the development of careers in tropical medicine from medical school onward and in the process to shoulder our responsibilities to expand our programs in research in tropical medicine.

e. Injuries

WE HAVE NO INFORMATION ON THIS.

III. BIOLOGICAL WARFARE

Over the centuries infectious disease has played an important, and in numerous instances, a decisive role in determining the outcome of individual military campaigns, and of entire wars. Until World War II deaths from disease exceeded those resulting from battle wounds in all wars in which the U. S. Army participated. For the first time in that latter conflict, scientific advances in the intervening years had provided a sufficiently improved basis for care of casualties that the relative importance of death from disease declined. Among the most important of these scientific advances incidentally, was the discovery of antibiotics by a biological scientist.

If we now turn our attention from mortality to a much more meaningful measure of loss of human productivity, namely morbidity, we again find that the loss of effective man-days resulting from disease by far exceeded those due to battle injuries in World War II. Indeed, even in present day civilian life, infectious diseases, primarily the respiratory diseases due to viruses, are the major reason for absence of workers from factories and children from school.

While the preceding remarks are oriented largely to the attack of man by biological agents, it should be emphasized that both his crops and domestic animals are also susceptible to devastation from infectious disease. The destruction of food, the loss of economically important plant products such as fibers and oils, and the death or reduced productivity of livestock can result in major consequences to the health, welfare, and strength of a nation.

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In the early part of World War II, in the months just preceding the entry of the United States into that conflict, and on a more urgent basis thereafter, a number of consultant committees were convened to advise on the feasibility and potentialities of Biological Warfare, and the threat it might pose to our nation. Most of the critically needed information required for clear-cut answers to these questions was not available at that time. Nevertheless, it was the considered scientific judgment of the members of these committees that an enemy nation could, with a concerted effort in the biological sciences, develop an effective weapons system based upon the purposeful introduction of infectious disease, and that BW represented a unique, novel, and potentially high significant mode of warfare which might pose a substantial threat to the United States. An active research and development program in BW was initiated in 1943 based upon these deliberations and their resulting recommendations.

In broad terms, the objectives of the research on BW have been to ascertain conclusively whether this mode of warfare is feasible, if so, to define its potentialities and limitations, to evaluate the threat it poses to our nation, and its armed forces in the field, and to develop appropriate defensive and other counter-measures.

It has been determined that some fastidious pathogenic microorganisms can be grown on an industrial scale and that these mass-produced organisms display many of the same qualities of virulence, stability, susceptibility to chemotherapeutic agents, etc. that characterized the laboratory-prepared seed cultures and human cases from which they originated. Microorganisms isolated from naturally-acquired cases of infectious disease are the basic source of agents for investigation in BW research. However, extensive alterations in the characteristic qualities of these organisms can be achieved by appropriate genetic, nutritional, and biochemical manipulation.

Microbial aerosols travel downwind for considerable distances, and infection by the respiratory route occurs in certain instances, even though normal transmission is by a different route. Downwind travel of an aerosol is limited by the adverse effects of sunlight, relative humidity, oxidation, air pollutants, and many other factors which contribute to a loss of virulence or death of the organism.

The biological warfare research program has provided an affirmative answer to many of the basic questions upon which the World War II committees deliberated. Certain pathogenic microorganisms can be grown on an industrial scale, microbial aerosols can be generated that will travel many miles downwind, and, under suitable conditions, an infectious hazard can be created over large areas.

The threat of BW is sufficiently real to justify studying a variety of defensive measures. These have included instrumentation for detecting microbial aerosols and providing rapid warning so that protective steps could be initiated, evaluation of filters applicable to individual or collective protectors, and development of a number of gaseous or vapor-phase decontaminating agents. Medically oriented studies have focused on techniques for rapid identification of pathogenic microorganisms and improved methods for the diagnosis, treatment, and prophylaxis of those diseases that are of primary concern in BW.

Investigations have demonstrated that crop plants are susceptible to attack by either selected, biologically active chemicals, or pathogens that cause plant diseases. Chemicals are available that are producible on an industrial scale, that can be disseminated over wide areas, and that destroy plant growth by dessication or by disrupting normal growth activities. Plant diseases are know that, in nature, have spread over thousands of square miles and have caused widespread crop failures. The causative agents of these diseases can be prepared on a large scale and will cause infection of susceptible plant species as a result of airborne transmission. Detailed knowledge of the interrelationships of the pathogen and host, the rate and manner of disease development, and the damage resulting to the crop are all critical areas for study.

The BW research program was established to serve the defense needs of the nation. The conduct of the wide scope of research required to fulfill this mission provides a body of new information, much of which is suitable for publication in scientific journals or presentation at meetings of professional societies. Thus, in addition to accomplishing its primary mission in defense, the BW research program has made a number of significant contributions to the public welfare, health, and safety. A few examples follow.

Immunology. Vaccines, shown to be effective and safe in man, have been developed for a number of communicable diseases for which prophylactic agents were previously not available. These have included anthrax, botulism, Rift Valley Fever, Venezuelan Equine Encephalitis, and tularemia.

Experimental Airborne Infection. To a major extent, current information in this field of investigation is an outgrowth of the BW research program. From it have come equipment design, experimental procedures, interpretative

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concepts, and an array of information on the characteristics of microbial aerosols and experimentally induced infections. In addition, novel approaches are being applied to evaluate the role of the airborne route of transmission in the naturally acquired respiratory diseases which play such an important role in both civilian and military public health.

Safety in Medical Microbiology. The BW research program has pioneered in identifying the hazards involved in manipulating pathogenic microorganisms, and in developing building designs, equipment, and working procedures that will minimize or eliminate these hazards. These developments have been applied to the design of numerous pharmaceutical, public health institute, and university laboratories. A unique current application of this information regarding microbiological safety is in the design of the NASA Lunar Receiving Laboratory. This institution will receive and study specimens retrieved by the Apollo missions to the Moon in order to ascertain whether they have any unique or infectious hazard for live forms of Earth.

Vegetation Control. Early work with 2,4-dichlorophenoxyacetic acid and 2,4,5-trichlorophenoxyacetic acid in conjunction with the Department of Agriculture played a major part in the development of the weed and vegetation control technology now in widespread use in the agriculture of the United States and the world.

Physiological Specialization of Piricularia Oryzae. The BW program has made major contributions to the knowledge of specialization in P. oryzae, the cause of rice blase. This information is of great value in breeding programs of disease resistance in rice.

Plant Disease Epidemiology. Through development of techniques and instrumentation, the quantitation of host-pathogen behavior under field epidemiological conditions has been markedly improved. The incorporation of this information with physical measurements of the host's environment has led to improvements in the ability to predict behavior of plant disease epidemics.

Rinderpest Vaccine. The first highly effective vaccine for this contagious and fatal disease of cattle was developed in the early years of the BW program. The efficacy of the vaccine was demonstrated, and subsequently it was provided to several countries where rinderpest is an endemic problem.

The Defense Department has established a number of unusual facilities for the conduct of the research, development, production of agents, and testing required for a program in BW. These facilities are provided with extraordinary provisions for investigating highly pathogenic microorganisms with assurance of the safety of the workers involved and of the surrounding community. Many of these facilities are unique and permit experimentation that cannot safely be conducted elsewhere in this nation. These facilities are vital to the proper conduct of the BW program and should be upgraded periodically to take advantage of advances in technology.

The many valuable contributions of the BW program to scientific knowledge and to the public welfare deserve special recognition. Full support should be afforded to continuation of the practice of publishing in all instances unless military security considerations dictate otherwise.

In order to prepare an adequate defense against BW, it is necessary to have a comprehensive and completely up-to-date understanding of the offensive capabilities of biological agents and weapons for their dissemination.

A continuing and vigorous research and development program must be maintained in both the defensive requirements for, and in the offensive potentialities of BW if this nation is (1) to understand fully the threat inherent in this mode of warfare, and (2) to provide maximal protection to its citizens from such an eventuality.

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IV. DETERIORATION OF MATERIALS OF BIOLOGICAL ORIGIN AND OF MATERIALS IN GENERAL BY ORGANISMS.

New materials, particularly synthetics, and many modes of chemical treatment are materially reducing ~~hazards of~~ deterioration caused by microorganisms. Research financed and carried out by the Department of Defense have made distinct contributions in this field. Even though the situation is much improved over that of a few decades ago the ideal has not been achieved and further research is needed. During the last world wars we experienced a great deal of deterioration of electronic equipment due to high humidity and growth of fungi. The problem is being attacked through attention to design, based on exclusion of moisture. It entails selecting materials with minimum affinity for moisture and high natural resistance (indigestibility) to microbes.

Microorganisms have been known to modify our fuel to the extent that ~~they~~ ~~are~~ no longer suitable for airplanes. Sulate-reducing bacteria generate hydrogen sulfide; bacteria and fungi are particulate matter that clogs filters and fine orifices. Almost always there is an obvious aqueous phase, and biological activity is greatest at the water-fuel interface. Sometimes the water is finely dispersed in the fuel, sometimes the sampling procedure does not include the underlying layer of water. Both cases create the impression that the organisms can grow without water. In general, active microbial growth in a fuel system is a strong indicator that water-exclusion measures are inadequate.

Further studies are needed to describe and characterize the organisms that can metabolize hydrocarbon. The physiology of these microorganisms are very poorly understood and very few microbiologists concern themselves with them.

Microorganisms we know now decompose gasoline and fuel but recent work indicates that they can also decompose other petroleum products such as asphalt for roadbuilding. It appears that for ~~every~~ compound produced by nature there are microorganisms capable of decomposing them. Therefore we need to be concerned about the biological deterioration in naturally occuring materials in whatever form they may be. This is particularly important in warmer climates where temperatures are nearly always favorable to the growth of these organisms. It is pertinent to national defense therefore that funds be made available for microbiologists to study the physiology of some of these "garden" organisms.

V. CIVIL DEFENSE

The current medical civil defense effort is based upon a number of assumptions which include the unavailability of hardened shelters. As a result, only limited fallout protection will be available in the event of a massive attack. Analysis of the availability of physician survivors of an attack as well as available hospital facilities indicate that the rate of survivors will be dependent more on the availability of trained manpower than on any other single factor. Trained medical personnel, however, will be of little use without adequate supplies and equipment properly distributed. Some provision has been made for the stockpiling of hospitals, equipment and supplies. In any case, however, these supplies need to be renewed and relocated and expanded to provide a thirty-day supply of equipment, drugs, and the like. In spite of the relatively pessimistic view taken by many, it would appear that adequate supplies and equipment, if properly located, could save millions of lives in a nuclear attack.

It would seem prudent to increase the number of personnel who could provide some form of medical assistance during the post attack period. Various civil defense agencies at the federal and local levels have undertaken a number of training programs for the civilian population. Indeed, approximately two million people are now receiving some form of civil defense training. Nevertheless, it is quite clear that the civilian population, either due to apathy or other reasons, have not

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chosen to take advantage of civil defense training. Experience to date would indicate that simply augmenting the number of courses available on a voluntary basis is not likely to increase the number of trained civilians. It is unlikely that some form of compulsory training would be acceptable to the population at large unless such a program was integrated into current educational programs.

The availability of food, water, and sewage disposal are of great importance with respect to post attack survival. The Department of Agriculture and a number of other agencies have been given responsibilities in terms of civil defense. With respect to food, the Department of Agriculture has set up an extensive program at the federal, state, and local levels. Personnel who make up this organization are equipped and trained to carry out radiological monitoring, food inspection, water inspection, and to assist the local population in obtaining critical food items. The panel feels that there are not adequate stockpiles of food currently available. It must be kept in mind that large reserves of cereal grains have been depleted over the past few years. Concurrently, the food industry, because of technological advances and better distribution methods, tend to maintain lower inventories. As a result, there is serious doubt that food supplies available in a post attack situation would be adequate for the majority of the survivors.

Recommendation. [illegible] ~~The panel recommends~~ that the federal government explore ways in which medical civil defense training might be made available more generally young people to all ~~secondary school students~~, perhaps in conjunction with current programs on physical fitness. It further recommends that the status of food supplies available in a post attack situation be reviewed carefully.

V. CIVIL DEFENSE

The current official national policy on civil defense identifies nuclear weapons as the primary threat to this country and relegates biological and chemical warfare to a lower level of concern at this time. It is important to emphasize, and indeed the official policy explicitly recognizes, the need for keeping thepotentialities of BW under constant review and of supporting research on methods of rapid detection, warning, identifying, reporting, analyzing, and defending against biological agents. This review must include a continuing analysis of scientific advances related to this mode of warfare, improvements in military technology, and intelligence regarding the activities and intentions of other nations in this regard.

The late ~~President Kennedy~~ had a thorough reappraisal made of responsibilities in civil defense and in 1961, announced that operational functions in this field would be transferred to the Department of Defense. Additionally, the peacetime competence of all Federal agencies would be employed to the fullest to safeguard people and industry, and to assure continuity of government at every level. Accordingly, by a series of Executive Orders, the President established the Office of Emergency Planning as a staff arm of his Executive Office to provide the central point of leadership and coordination for all phases of nonmilitary defense. The full responsibility for developing and executing a national civil defense program for chemical, biological, and radiological warfare was assigned to the Secretary of Defense. In implementing this broad responsibility the Secretary of Defense is aided by other Federal agencies. Of major significance are the responsibilities of the Secretary of Agriculture for national emergency plans and for research covering defense against BW, CW, and RW as they pertain to agricultural activities. In a similar fashion, the Secretary of Health, Education, and Welfare maintains stockpiles of emergency medical supplies and equipment, and is responsible for emergency plans and for research covering health services, i.e., preventive and curative care related to human exposure to radiological, chemical, and

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A few, selected topical headings will illustrate the important role of the biological sciences in assuring maximal survival after nuclear or biological warfare attacks covering entire cities or even larger geographical areas:

<u>Medical Aspects of Civil Defense Against Nuclear Attack</u>

a. Medical consequences of radiation
b. Enhancement of resistance to radiation
c. Infectious diseases of endogenous origin as a consequence of radiation.
d. The influence of radiation on resistance to infection from exogenous sources.

<u>Agricultural Aspects of Civil Defense Against Nuclear Attack</u>

a. Post-attack determination of safety of food supplies
b. Stockpiling of fertilizers and insecticides.
c. Stockpiling of seeds

<u>Medical Aspects of Civil Defense Against Biological Warfare</u>

a. Lack of familiarity among American physicians with infrequently occurring or exotic human infectious diseases likely to be important in BW e.g., smallpox, arthropod-borne viral diseases, inhalation anthrax, etc.
b. High level of susceptibility of the population of the United States to many diseases of potential importance in BW.
c. Requirements for the development and evaluation of a wide variety of prophylactic agents against infectious diseases of BW importance, the manufacture of these products on a large scale, and decisions for their administration to the population of the country in advance of hostilities.

Veterinary Aspects of Civil Defense Against Biological Warfare

a. Vulnerability of economically important domestic animals to epizootic diseases, especially those of exotic origin such as foot and mouth disease, African swine fever, rinderpest, African horse sickness, etc.

b. Lack of familiarity of American veterinarins with exotic animal diseases likely to be important in BW, and consequent difficulties and delays in diagnosis.

c. Mobility of livestock in the United States and the resultant opportunities for epidemic spread of animal diseases.

d. Lack of resistance in animal population of United States to exotic animal diseases.

Medical Aspects of Disaster Medicine Important in Civil Defense Activities Subsequent to Either Nuclear or Biological Warfare Attack

a. Mass immunization procedures and materials for disaster medicine.

b. Production, stockpiling, and periodic replacement of prophylactic and therapeutic agents.

c. Sanitation of water supplies.